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GEOGRAPHIC SUPPORT PROJECT

THE SEAS AROUND NOVAYA ZEMLYA



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THE SEAS AROUND NOVAYA ZEMLYA

General

The Novaya Zemlya archipelago is bordered on the west by the Barents Sea and on the east by the Kara Sea. At its southern end, approximately 100 miles north of the USSR mainland, the Proliv (strait) Karskiye Vorota connects the Barents and Kara Seas and separates the archipelago from Ostrov (island) Vaygach. Novaya Zemlya stretches for 620 miles in a curving northeast-southwest direction and varies in width from 40 to 90 miles. The two major islands, North Island and South Island, are separated by the very narrow, winding Proliv Matochkin Shar. The islands are rocky and barren and are notched by many deep bays and fiords, some measuring up to 35 miles in length. Most of the North Island is covered with glaciers.

Conditions in the seas around Novaya Zemlya vary greatly from west to east. The Barents Sea has a maximum depth of only 800 feet. The cold climate of the Barents Sea area is moderated somewhat by the warming influence of the North Cape Current of the Gulf Stream, and the ice-free season lasts 4 to 5 months. The Kara Sea, however, is deep. A long trough that in places is 1,800 feet deep parallels the coast. The climate is extremely cold and the ice-free season averages only 3 weeks in duration.

Water Depths

The seas adjacent to Novaya Zemlya are relatively deep in comparison with other Arctic seas north of the USSR. On the east side of the archipelago, the Kara Sea bottom drops rapidly offshore to the Novaya Zemlya Trough, which parallels the coastline. Depths reach 330 feet in the first 10 miles, average 660 to 1,000 feet for the next 30 to 60 miles in the Novaya Zemlya Trough -- where the maximum depth is 1,800 feet -- and beyond the trough are generally 330 to 660 feet. The smaller St. Anna Trough near the northern tip of North Island has depths of as much as 2,000 feet.

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The Barents Sea is generally shallower. The sea bottom drops fairly rapidly offshore and reaches depths of 330 feet within 1 to 30 miles. Areas farther offshore average 330 feet to 660 feet, with some areas as low as 800 feet. Around the southern end of South Island, where Proliv Karskiye Vorota connects the Barents and Kara Seas, maximum depth reaches only 690 feet. The shallowest waters are found at the western approaches to Proliv Matochkin Shar (depths of 65 to 75 feet) and at a point 87 miles west of South Island at latitude 71°40'N (depth of 177 feet).

Bottom Sediments

Data concerning bottom sediments in the waters around Novaya Zemlya are incomplete, particularly for the area northwest of the islands. In the Barents Sea the types of sediment and their distribution are notably diverse, and mud, sand, gravel, rock, and shell exist alone or in combination far out to sea. In the Kara Sea north and east of the islands there are fewer kinds of sediments; mud covers most of the bottom, except for rock and gravel near the shore. For Proliv Karskiye Vorota, sedimentation data are extremely sparse; mud predominates toward the middle of the strait, and various combinations of mud, sand, gravel, and rock occur along the north and south shores.

Water Color and Transparency

Data on water color and transparency in the Barents Sea are available only for the period May through September. During that period water color, according to the Forel Scale, ranges from blue and greenish blue in the northwest to bluish green and light green in the south. Transparency values (depths at which a white disc 11.8 inches in diameter disappears from sight when lowered into the water) range from 66 to 98 feet north of 71°N and from 36 to 66 feet south of 71°N. In the Kara Sea a zone of blue to greenish blue water usually extends from the northern end of Novaya Zemlya close inshore as far south as Proliv Matochkin Shar. The southwestern inshore sector has greenish blue or bluish green waters. Farther east the color ranges from bluish green through green to light green. Along the entire east coast the average transparency ranges from 33 to 66 feet. Farther out to sea is a zone in which transparency varies from almost opaque to a maximum of 33 feet.

Currents and Tides

Two currents -- the Murman Current and the Litke Current -- flow in the seas west of Novaya Zemlya. The Murman Current, a branch of the warm North Cape Current of the Gulf Stream, flows eastward across the southern

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part of the Barents Sea and then branches just before reaching Novaya Zemlya -- one branch turning northward along the west coast and the other continuing eastward through the central and southern part of Proliv Karskiye Vorota. Because of the extensive mixing with polar water and the influence of local winds, the speed and direction of the Murman Current are extremely variable. Along the west coast and through the Proliv Karskiye Vorota, speeds are generally less than 5 knots. The Litke Current, originating in the cold Kara Sea, flows westward through the northern edge of Proliv Karskiye Vorota into the Barents Sea and continues northward close to the west coast of Novaya Zemlya. The speed of this current is generally only about 0.5 knot, and at times movement of the water is imperceptible.

East of Novaya Zemlya, currents follow a generally counter-clockwise direction. The Novaya Zemlya Current flows southward along the east coast of the islands to the entrance of Proliv Karskiye Vorota, where the Litke Current branches off toward the Barents Sea. After passing the entrance to Proliv Karskiye Vorota, the Novaya Zemlya Current turns gradually eastward and then northward and becomes the Yamal Current. The Yamal Current completes the circle by curving northwestward and westward toward Novaya Zemlya, where it merges again with the Novaya Zemlya Current. Although average speeds of the Novaya Zemlya Current are less than 5 knots, abnormal wind conditions have been known to alter the velocity to a considerable extent.

Data on subsurface currents in the Novaya Zemlya area are scarce. Because of the shallowness of the Barents Sea, most of the water entering it is surface water. The Murman Current transports water that is high in saline content eastward into the area, and part of it sinks and spreads out to the east and northeast as subsurface currents. These subsurface currents apparently follow a path similar to the surface currents, but at slower speeds. In the Kara Sea the subsurface circulation patterns are probably similar to those of the surface.

The tidal ranges of the waters close to Novaya Zemlya are generally small, varying from 1 foot or less on the east coast to 1 to 3 feet on the west coast. During spring tides (new-moon and full-moon phases when sun and moon act in conjunction and opposition to give extreme high and low tides) the tidal range is greatest (3.2 feet) near the western entrance to Proliv Matochkin Shar. Almost all tides in the Novaya Zemlya area are semidiurnal; that is, two nearly equal low waters each tidal day. In one small area along the southwest coast, however, the tides are mixed -- two markedly unequal high waters and/or two markedly unequal low waters each tidal day during most of the month.

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Ice Conditions

Ice conditions in the seas around Novaya Zemlya differ markedly from east to west and also from year to year. On the eastern side of the North Island, freezeup generally begins in mid-September, with the formation of fast ice (ice attached to the shore) along the seacoast and in most of the bays and inlets. With the onset of colder weather in October, new scattered ice (0.1 to 0.5 ice cover) develops over the Kara Sea, except in the southwest near Proliv Karskiye Vorota. During November the formation of close ice (0.8 to 1.0 ice cover) moves in from the colder eastern sectors of the Kara Sea and spreads rapidly westward and southward, joining the fringe of fast ice along the eastern coast of the islands. By December the entire Kara Sea and Proliv Karskiye Vorota generally are covered by close ice.

Along the west coast of Novaya Zemlya initial freezeup is delayed about a month and a half, because of the warming influence of the North Cape Current of the Gulf Stream. During November a fringe of fast ice develops along the western coast of the islands, forming first in the north and advancing southward. At the same time a substantial amount of new winter ice forms offshore, and a broad area of broken ice (0.5 to 0.8 ice cover) in advance of the concentrated polar pack ice slowly moves southward from the Arctic Ocean. Through the cold season the ice continues to thicken and to advance seaward and southward, and by December close ice prevails over the entire western side of the Barents Sea adjacent to Novaya Zemlya. By March it is over all of the sea east of 48°E.

Most of the ice in the Barents Sea and the Kara Sea is winter ice, which develops locally and melts in place in summer. Usually less than 12 feet thick, this ice is subject to the strong forces of winds and tides, which cause it to raft (one ice cake overrides another) and ridge (sometimes buckles up to 24 feet in height). While not as formidable an obstacle as the polar ice from the north, which only occasionally intrudes into the northern part of this area, winter ice does present a distinct barrier to navigation

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The melting and breakup of the ice begin in the east-central part of the Barents Sea in late April, spread first toward the east to that part of Novaya Zemlya that lies between approximately 71°N and 76°N and then slowly progress both northward and southward along the coast. By late May the ice between 71°N and 76°N has usually dissipated into broken ice and by mid-June most of the ice south of 74°30'N has dissipated into scattered ice. By mid-July open seas prevail in the area between approximately 71°N and 75°N with scattered ice to the north and south. By late July the entire western side of Novaya Zemlya, as well as Proliv Karskiye Vorota, is ice free. Only along the northwest edge of North Island do broken ice and scattered ice tend to persist for several weeks longer.

East of Novaya Zemlya the thinning out of close ice occurs in mid-June in the south and gradually spreads northward so that by mid-July most of the Kara Sea is covered by broken ice. As the broken ice dissipates into scattered ice in late July and August, limited navigation with heavily reinforced vessels becomes possible. Distinct hazards, however, are presented by the heavier ice concentrations that because of local southerly ocean currents tend to persist in the portions of the Kara Sea immediately adjacent to Novaya Zemlya. By late August the area south of about 74°N is generally clear of ice, and by early September the entire east side of the islands is relatively clear and open to navigation. Conditions may remain suitable for navigation for 2 or 3 weeks, but they are subject to sudden change as a strong westerly or northwesterly wind can easily bring pack ice crushing in around the northern end of the islands. In recent years these ice-free periods have occurred quite regularly every fall, but occasionally the seas along the northern and eastern coasts of Novaya Zemlya have been blocked by ice the year round.

Sea and Swell

Sea and swell conditions around Novaya Zemlya are subdued by the ice cover, which restricts the effect of wind on the water throughout most of the year. Seas ranging from rough (5 to 8 feet) through high (more than 12 feet) generally occur only in open water or zones of scattered ice. High swell, however, does penetrate the edges of the ice pack for short distances.

West of Novaya Zemlya in the Barents Sea the roughest seas occur in autumn, when waves 5 feet or higher are common from 20 to 40 percent of the time in the south and from 10 to 30 percent of the time in the north. Calmest seas are in the summer, when waves of 3 feet or lower occur for 80 to 90 percent of the time. Swells are moderate (6 to 12 feet) or

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less for 80 to 90 percent of the time during the ice-free season, with maximum occurrence of high swell (greater than 12 feet) in the southern sectors during the autumn. In the open area southwest of the ice pack in winter and spring, seas with waves 5 feet or higher occur 10 to 30 percent of the time.

East of Novaya Zemlya in the Kara Sea during the summer, waves 5 feet or higher occur 10 percent of the time in the south and 10 to 20 percent of the time in the north. During the autumn they occur 10 percent of the time throughout the Kara Sea. Swells occur only in summer, when they exceed 12 feet for 10 percent of the time.

Biology

The intensity of fouling by marine organisms in sea areas around Novaya Zemlya ranges from very slight to moderate. Most fouling of this type occurs near the shore on the west side of the islands in the region south of Proliv Matochkin Shar and along the shores of Proliv Karskiye Vorota. In these areas fouling by attachment of bryozoans, hydroids, tunicates, barnacles, and mollusks is most common. Of more significance, however, is the seaweed growth that occurs in the coastal zone around Novaya Zemlya, particularly on the southwest side of the islands. Here, during the summer at depths between 6 and 65 feet, kelp (Laminaria) grows so densely in places that it obscures the bottom and acts as an entangling agent. Large tracts off the west coast of the islands are also covered with calcareous algae (Lothothamnion and Lithophyllum). These algae, growing between depths of 30 and 100 feet, form a thick, hard substratum that serves as an attaching medium for kelp.

Marine mammals most common to the seas around Novaya Zemlya are the Atlantic white whale (Delphinapterus leucas), ringed seal (Phoca hispida), bearded seal (Erignathus barbatus), Greenland seal (Phoca groenlandica), and walrus (Odobenus rosmarus). White whales migrate eastward from their winter waters in the western Barents Sea to the Kara Sea and the White Sea every June. During June and July they are common in the eastern Barents Sea, on the west side of Novaya Zemlya, but by August most of them have reached the Kara Sea. They remain in the Kara Sea until October, when they return westward to the western Barents Sea. White whales are usually 12 to 18 feet long, travel in herds, and feed on large fish and crustaceans. In some years seals appear in the area, but little is known about their numbers or their migratory habits. Walruses are common the year round on the eastern side of the islands, and during September and October they are found off the northern end of Novaya Zemlya. None of the marine mammals common to the Novaya Zemlya

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area are known to be hazards to navigation. [redacted]

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Climate

Novaya Zemlya has short, chilly summers, with much drizzling rain and many fogs, and long, cold, humid winters. Spring and fall are very brief seasons. The average daily temperature near sea level is above freezing from early June to early October in the south and from late June until shortly after the middle of September in the north. July and August are the warmest months, with average monthly temperatures ranging from about 43°F in the south at Malyye Karmakuly, to 35°F in the north, at Mys Zhelaniya (see Table 1). Absolute maximums of 75°F at Malyye Karmakuly and 59°F at Mys Zhelaniya have been recorded in August. After August, temperatures decline rapidly, and by early October, average daily temperatures are below freezing throughout the islands. From January through March, the coldest period, the average monthly temperature is 6°F at Malyye Karmakuly and drops to -5°F at Mys Zhelaniya. Because of the warming effect of the North Cape Current of the Gulf Stream, the Barents Sea area is 5 to 15 degrees warmer during the winter than comparable latitudes in the Kara Sea area.

Precipitation over the islands is between approximately 12 and 18 inches a year, with amounts generally decreasing from west to east and from south to north. The annual precipitation at Malyye Karmakuly is 18.1 inches, and at Mys Zhelaniya it is 12.8 inches (see Table 2). More than 75 percent of the precipitation falls as snow and the remainder as drizzly rain. Snow covers the islands for 220 days a year in the south and for 280 days a year in the north, with maximum accumulations over much of the islands reaching 20 inches. Blowing snow, frequent in winter, sometimes reduces visibility to almost zero.

Strong winds are common to the area throughout the year, but they occur most frequently from November to March. Numerous cyclonic storms pass eastward over the Barents Sea, beginning in September and reaching a maximum in February. Winds associated with local storms are also significant. A bora-type storm, known locally as the stok, is most common. It occurs when winds descend from the mountainous interior to the coastal areas and then move out to sea. During such storms, winds with gusts of 115 miles per hour and over are possible, and any unsecured items can easily be blown away. The stok usually lasts about 24 hours, but some have been known to continue for as long as 6 days. The winds gradually abate as they move seaward, and complete calm may prevail 10 to

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15 miles from land during the period of a stok on the coast.

Fog and clouds are common to the Novaya Zemlya area. Fog occurs most frequently from June through September, when warm air from the land passes over relatively cooler seas (see Tables 3 and 4). Most fogs last no more than 12 hours, and visibility is generally restricted to 660 to 1,640 feet (500 meters), although, occasionally, visibility is less than 660 feet (dense fog). Mys Zhelaniya, with about 76 days of fog a year, is the foggiest spot on the islands and has about 17 days of fog a month during July and August. Matochkin Shar, with about 40 days of fog annually, is one of the stations with least fog because winds blowing through the strait disperse it rapidly.

Cloudiness is at a minimum of 60 percent in late winter and early spring, roughly the period of least open water. With the onset of the spring thaw, cloudiness increases; and by late summer, the period in which the extent of open water is greatest, it has reached a maximum of 80 to 85 percent. At Mys Zhelaniya, for example, the averages for the number of cloudy days (0.8 cloud cover and greater) in February and March are 9 and 10, respectively, whereas in August and September they are 26 and 25. Over most of the area thick stratus constitutes the most frequent type of cloud cover.

Traffic

Sea traffic in the Novaya Zemlya area includes local shipping, Northern Sea Route shipping, and Soviet Navy maneuvers. Local traffic consists of Soviet supply ships from the mainland, serving polar stations and other settlements along the coast during the summer navigation season. Ships on the western part of the Northern Sea Route, which may include many of non-Soviet registry, travel between the Barents Sea and the Kara Sea by three routes: around the southern tip of Novaya Zemlya through Proliv Karskiye Vorota, around its northern extremity at Mys Zhelaniya, and between the two islands via Proliv Matochkin Shar. Most ships use Proliv Karskiye Vorota, which is open to navigation from early July to early October. Occasionally, when wind-driven ice blocks Proliv Karskiye Vorota, shipping may be routed to the north around Mys Zhelaniya. Proliv Matochkin Shar has not been used as a shipping lane in recent years. After the navigation season, several of the heavier Soviet ice-breakers usually move to waters north of Novaya Zemlya to set up scientific drift stations, Drifting Automatic Radio Beacons (DARBS), and Drifting Automatic Radio Meteorological Stations (DARMS). Occasionally since 1957 the USSR has declared extensive areas in the Barents and Kara Seas closed to shipping, usually at times of nuclear tests or naval maneuvers in the area.

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Attachments

The following publications and maps, which provide additional details on the Novaya Zemlya area, are attached to Copy 1 of this report.

1. U.S. Hydrographic-Oceanographic Data Sheet, HODS S 0050-0003 (1952), HODS 0044-0004 (1960), and HODS 0049-0005 (1960). CONFIDENTIAL. These three data sheets (totaling 40 pages) give details of the physical characteristics of three specific areas near the shore of Novaya Zemlya, including data on bathymetry, tides, currents, sea and swell, physical properties, ice bottom sediments and geology, and biology; and for one area, terrestrial magnetism and water exchange.
2. U.S. Naval Oceanographic Office Chart 17,222-5, Mys Kanin Nos to Ostrov Belyy, 1:1,000,000, 1964. FOR OFFICIAL USE ONLY. This US chart is based on USSR charts and corrections issued through 1958. It covers the Novaya Zemlya South Island, Proliv Karskiye Vorota, the northern coast of the USSR mainland, other islands along the mainland, and part of the Barents and Kara Seas. It includes soundings (depths) in fathoms.
3. U.S. Naval Oceanographic Office Chart 17,222-6, Proliv Matochkin Shar to Ostrov Uyedineniya, 1:1,000,000, 1964. FOR OFFICIAL USE ONLY. This US chart is based on USSR charts and corrections issued through 1958. It covers the Novaya Zemlya North Island, small portions of the South Island and the USSR northern mainland, other islands along the mainland, and part of the Barents and Kara Seas. It includes soundings (depths) in fathoms.
4. U.S. Navy Hydrographic Office Chart U.S.S.R. 695, Approaches to Karskiye Vorota and Yugorskiy Shar, 1:250,000, 1963. FOR OFFICIAL USE ONLY. This US chart is compiled from USSR charts based on surveys to 1940. It covers the southern end of Novaya Zemlya, all of Ostrov Vaygach, the northern end of Poluostrov Yugorskiy, and part of the Barents and Kara Seas. It includes soundings (depths) in meters.
5. Geographic Intelligence Report, Novaya Zemlya, CIA/RR-G-18, January 1958. SECRET/NOFORN [REDACTED] This 45-page report gives a comprehensive

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portrayal of the physical environment of Novaya Zemlya as well as the military, economic, and scientific activity on or near the islands. It includes the following two maps:

- A. CIA 25881, Novaya Zemlya, 1:1,000,000, July 1957. SECRET. This map, which is based on numerous Soviet and US sources, covers the Novaya Zemlya archipelago, Proliv Karskiye Vorota, the northern end of Ostrov Vaygach, and part of the Barents and Kara Seas. It includes soundings (depths) and contours in meters and locates and identifies military, naval, and air installations, settlements, natural resources, and economic activities.
- B. CIA 25882, Proliv Matochkin Shar, 1:175,000, June 1957. SECRET. This map covers the strait and its immediate environs. It includes soundings (depths), heights, and contours (all in meters), as well as settlements and polar stations.

Other Supplementary Sources

1. Oceanographic Atlas of the Polar Seas, Part II Arctic, U. S. Navy Hydrographic Office Pub. No. 705, 1958. UNCLASSIFIED. This atlas provides detailed data on the tides and currents, physical properties, ice conditions, sea and swell, geology, and biology of the seas in the arctic region.
2. NIS 107, Section 3, Arctic Basin, Oceanography, January 1957. CONFIDENTIAL. Provides detailed oceanographic data on the Arctic Basin, including the Kara and Barents Seas.
3. NIS 104, Part XI, Section 3, Atlantic Basin, Oceanography, August 1956. CONFIDENTIAL. Provides detailed oceanographic data on the Atlantic Basin, including the Barents Sea.

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Table 1

Average Temperature a/
(in degrees Fahrenheit)

	<u>Malyye Karmakuly</u> ($72^{\circ}23'N$ $52^{\circ}44'E$)	<u>Matochkin Shar</u> ($73^{\circ}16'N$ $56^{\circ}27'E$)	<u>Russkaya Gavan'</u> ($76^{\circ}11'N$ $62^{\circ}34'E$)	<u>Mys Zhelaniya</u> ($76^{\circ}56'N$ $68^{\circ}35'E$)
January	7	-2	0	-6
February	5	0	3	-2
March	7	-2	1	-6
April	10	7	4	1
May	24	21	20	16
June	34	33	33	29
July	43	40	37	35
August	43	36	36	35
September	37	34	30	30
October	27	29	18	21
November	16	10	7	3
December	5	4	1	-2

a. Data on the average temperature have been extrapolated from monthly temperature maps at 1:35,000,000 in the Fiziko-Geograficheskiy Atlas Mira, Moscow, 1964, pp. 206-209.

Table 2

Average Precipitation a/
(in inches)

	<u>Malyye Karmakuly</u>	<u>Matochkin Shar</u>	<u>Russkaya Gavan'</u>	<u>Mys Zhelaniya</u>
January	1.6	1.2	1.3	1.2
February	1.9	1.1	1.6	1.1
March	1.6	0.8	1.3	0.8
April	1.3	0.8	1.0	0.7
May	1.3	0.9	1.2	0.8
June	0.6	0.8	0.8	0.8
July	1.2	1.3	1.0	0.8
August	1.0	1.4	1.0	1.1
September	2.2	2.0	2.2	2.0
October	1.7	1.2	1.4	1.2
November	2.2	1.6	1.6	1.1
December	1.5	1.1	1.4	1.2
Annual	18.1	14.2	15.8	12.8

a. Data on the average precipitation have been extrapolated from monthly precipitation maps at 1:35,000,000 in the Fiziko-Geograficheskiy Atlas Mira, Moscow, 1964, pp. 215-217.

Table 3

Average Number of Days With Fog a/

	<u>Matochkin Shar</u>	<u>Mys Zhelaniya</u>
January	2.0	1.3
February	2.0	2.0
March	2.2	2.7
April	1.4	3.7
May	2.6	4.6
June	3.9	12.1
July	6.3	17.1
August	6.2	17.2
September	5.4	9.9
October	2.8	2.7
November	2.5	1.1
December	1.9	1.4
Annual	39.2	75.8

Table 4

Average Number of Days With Dense Fog a/

	<u>Matochkin Shar</u>	<u>Mys Zhelaniya</u>
January	0.5	0.4
February	0.3	0.2
March	0.0	0.6
April	0.3	0.2
May	0.2	0.8
June	1.2	2.4
July	2.5	7.0
August	1.9	4.4
September	1.3	1.6
October	0.6	0.2
November	0.0	0.1
December	0.0	0.2
Annual	8.8	18.1

a. The average number of days with fog and dense fog is based on data obtained from 1930 through 1939 included in Klimaticheskiy Ocherk Karskogo Morya, by Z. M. Prik, Moscow, 1946. According to Soviet definition, fog prevails when visibility is reduced to less than 3,281 feet (1,000 meters). Dense fog, as such, is not defined, but probably pertains to conditions of visibility reduced to less than 660 feet.

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